DOCUMENT RESUME

ED 463 631 EF 006 054

AUTHOR	Hertzberg, Randi, Ed.
TITLE	Concrete Masonry Designs: Educational Issue.
INSTITUTION	National Concrete Masonry Association, Herndon, VA.
PUB DATE	2001-08-00
NOTE	25p.; Theme Issue. Published monthly.
AVAILABLE FROM	NCMA Foundation, 2302 Horse Pen Rd., Herndon, VA 20171. Tel: 703-713-1900; Fax: 703-713-1910; Web site: http://www.ncma.org.
PUB TYPE	Collected Works - Serials (022)
JOURNAL CIT	Concrete Masonry Designs; Aug 2001
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Architecture; Building Design; Construction Materials; Educational Facilities Design; Elementary Secondary Education; *Masonry; *Prestressed Concrete; *School Buildings; School Construction
IDENTIFIERS	Cement; Cement Masons

ABSTRACT

This special journal issue addresses concrete masonry in educational facilities construction. The issue's feature articles are: (1) "It Takes a Village To Construct a Massachusetts Middle School," describing a middle school constructed almost entirely of concrete masonry and modeled after a typical small New England village; (2) "Lessons Learned," explaining why concrete masonry can be the material of choice for educational facilities; and (3) "CM Profiles: A High Performance School in Panther Country," discussing a concrete masonry school in Texas exhibiting best practices in school design and construction. The issue's regular departments "Around the Block" and "Detail of the Month," discuss Utah prototype schools and energy-efficient school designs for new construction. (EV)

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Masonry DESIGNS

Educational Issue

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Concrete Masonry: Bringing it All Together for Education

While young school children across the country may develop many different and varied perspectives on the experience of attending school, as adults, we uniformly want this to be a genuinely pleasant experience for them. School should be fun and positive and creative, yet we know sadly this is not always the case. And while the factors which contribute to a child's school experience are varied and many, one which is always on the list is the school building.

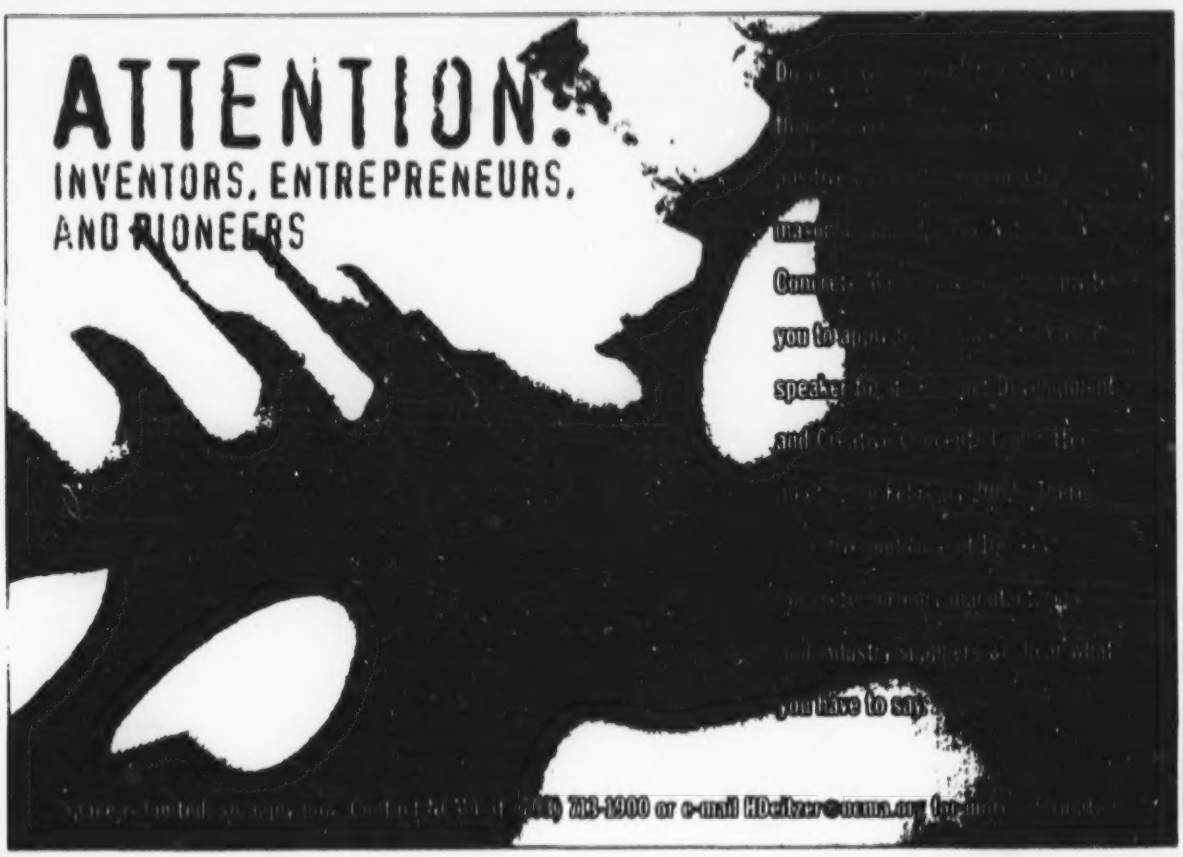
It is often challenging for a design firm to find the right materials to satisfy all the needs of the school district.

While the search for the ideal is always a part of the project scope, only occasionally does it materialize quickly. Working with a school district's faculty members, administrators, parents and students allows an architect to sharpen a design concept that would bring enthusiasm and excitement to the school without impacting the overall project cost or quality.

We have discovered that we can resolve many educational design requirements with the extensive use of concrete masonry. We have given consideration to other material choices, but are most satisfied with the contribution that concrete masonry makes in a building's design.

The colors, textures and design options are endless....an architectural firm's dream. ■

Boyd McAllister, Architect
VCBO Architecture
Salt Lake City, Utah



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Concrete Masonry DESIGNS

ON THE COVER:

Across the nation, concrete masonry is making the grade in the educational market.

FEATURES

6
It Takes a Village to Construct a Massachusetts Middle School
Constructed almost entirely of concrete masonry, the John T. Nichols Junior Middle School was modeled after a typical small New England village.

12
Lessons Learned
Perkins & Will Architectural has found concrete masonry to be the material of choice for educational facilities.

18
CM Profiles: A High Performance School in Panther Country
A Best Practice in School Design and Construction

DEPARTMENTS

4 Around the Block
Utah Prototype Schools

23 Detail of the Month
Energy-Efficient School Designs for New Construction

Concrete Masonry Designs showcases the qualities of design and construction using concrete masonry.

Concrete Masonry Designs is completely devoted to design techniques using standard and architectural concrete masonry units; concrete brick; unit concrete pavers and segmental retaining walls; and other concrete masonry products around the world. We welcome your editorial comments, ideas and submissions.

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Concrete Masonry Designs is published monthly by the National Concrete Masonry Association and distributed through the NCMA Foundation, dedicated to advancing and supporting the concrete masonry industry and the public interest through research and educational programs designed to meet the future needs of the industry.

Send address corrections to NCMA's Publications Department.

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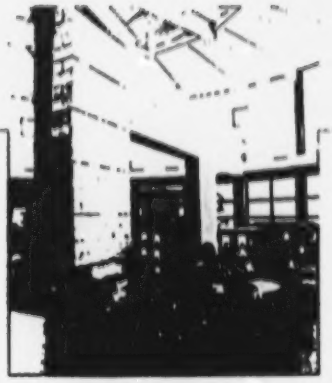


Utah Prototype Schools

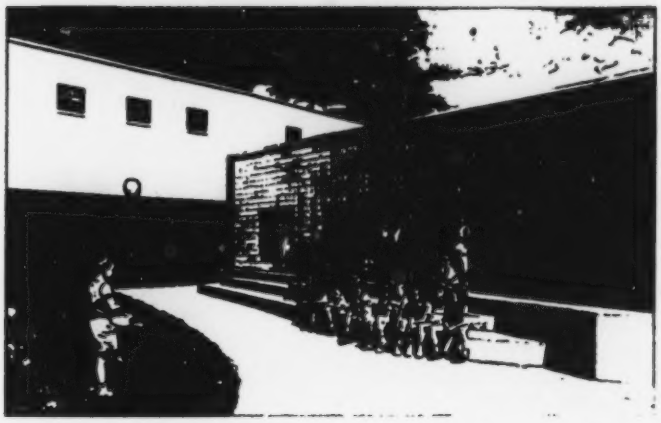
When the school board from Davis County came to Boyd McAllister and his colleagues at VCBO Architecture in Salt Lake City, Utah, the hope was that as designers they could make a positive building statement. To VCBO, the Davis County request was no different than any other school board requirements. Davis County administrators wanted a perfect building at a reasonable price. In fact, they wanted two of them, and possibly more, as this was to be a prototype design that could be used elsewhere as the needs became apparent.

Soon thereafter work began on the Creekside Elementary School in Kaysville, Utah, located at the base of the Wasatch Mountains, and the Lakeside Elementary School in neighboring West Point near the shore of the Great Salt Lake.

Early on, McAllister wrote that the project should be unique rather than limiting, it should liberate rather than stifle, and it should inspire creativity. Later he recalled, "This just seemed like a great opportunity to make an impact in the educational market and the staff here was quite excited about the possibilities."

The project planning budget did not allow much spending for the purpose of decorating the building, so the design team worked to incorporate decorative elements into the structure itself. With shapes and textures readily available among concrete masonry units, VCBO was able to provide a pleasant, inviting and functional environment without extensive spending.

The architectural team chose to use triangles, circles and squares or rectangles as teaching elements within the school design. These varied shapes were created with the help of the texture and color of concrete ma-



sonry and soon became cornerstones for many of the design elements in the building.

Starting with the entranceway, the design team created a colonnade that extended from the Media Center through the wall to the outside courtyard and across to the gymnasium. This 40-foot (4.2-meter) design element created columns of concrete masonry at eight-foot (2.4-meter) intervals that reinforced the theme of geometrical shapes and created a playful area as children soon learned to use them to play games of "hide-and-seek."

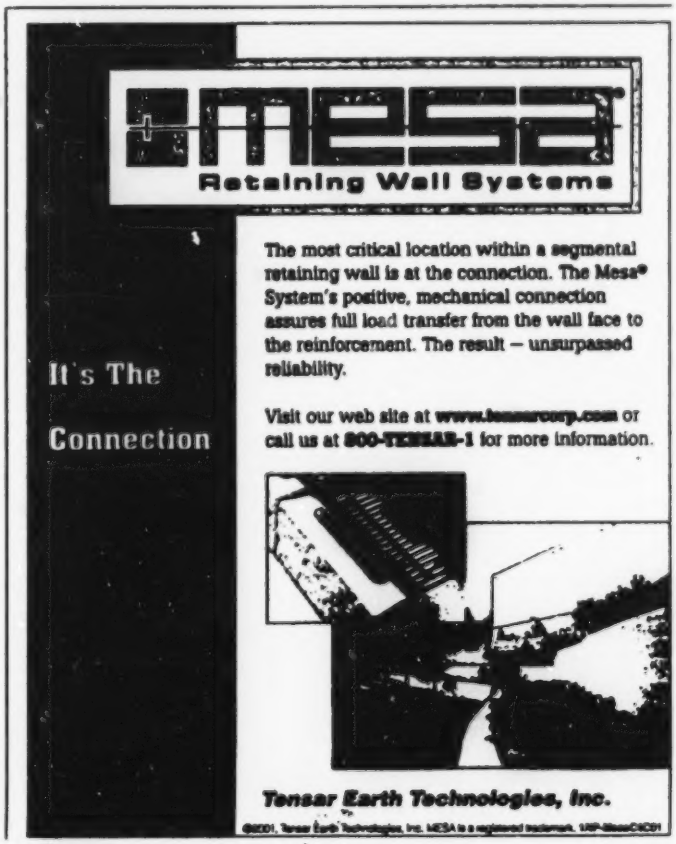
Karen Passey, principal at Lakeside Elementary reported that the children regularly congregate in the front courtyard and enjoy the creative design. To Passey, the entrance "had an excitement along with an invitation to the students. One of the younger children suggested that unlike the older school this 'school is fun and not scary.'"

Concrete masonry was also used to construct a recreational triangle in the commons area where children could relax and enjoy the building. Many of the faculty soon learned that this was an ideal spot for a change of pace from the structure of the classroom and took to making regular use of this area.

Texture on the outer walls of the building was created with smooth, ground-face concrete masonry in contrast with split-face units. These units were alternated along the exterior walls and served to define the size and location of individual classrooms. This was particularly apparent to the children when they were in one of the three outdoor classroom areas. Consistent with the geometrical theme, the exterior walls of the gymnasium were identified by alternating block patterns of smooth- and split-face concrete masonry units.

But all of the excitement has not worn away reports Gary Payne, administrator, facilities and planning, for the school district. "These buildings are entering their third year and both remain in excellent shape. The interior concrete masonry, particularly in the circulation areas, has been a wise choice. The faculty continues to discover ways to integrate the building into the curriculum."

At 73,000 square feet (6,782 square meters), both schools were completed with a final construction cost of $6.9 million or just under $95 per square foot. ■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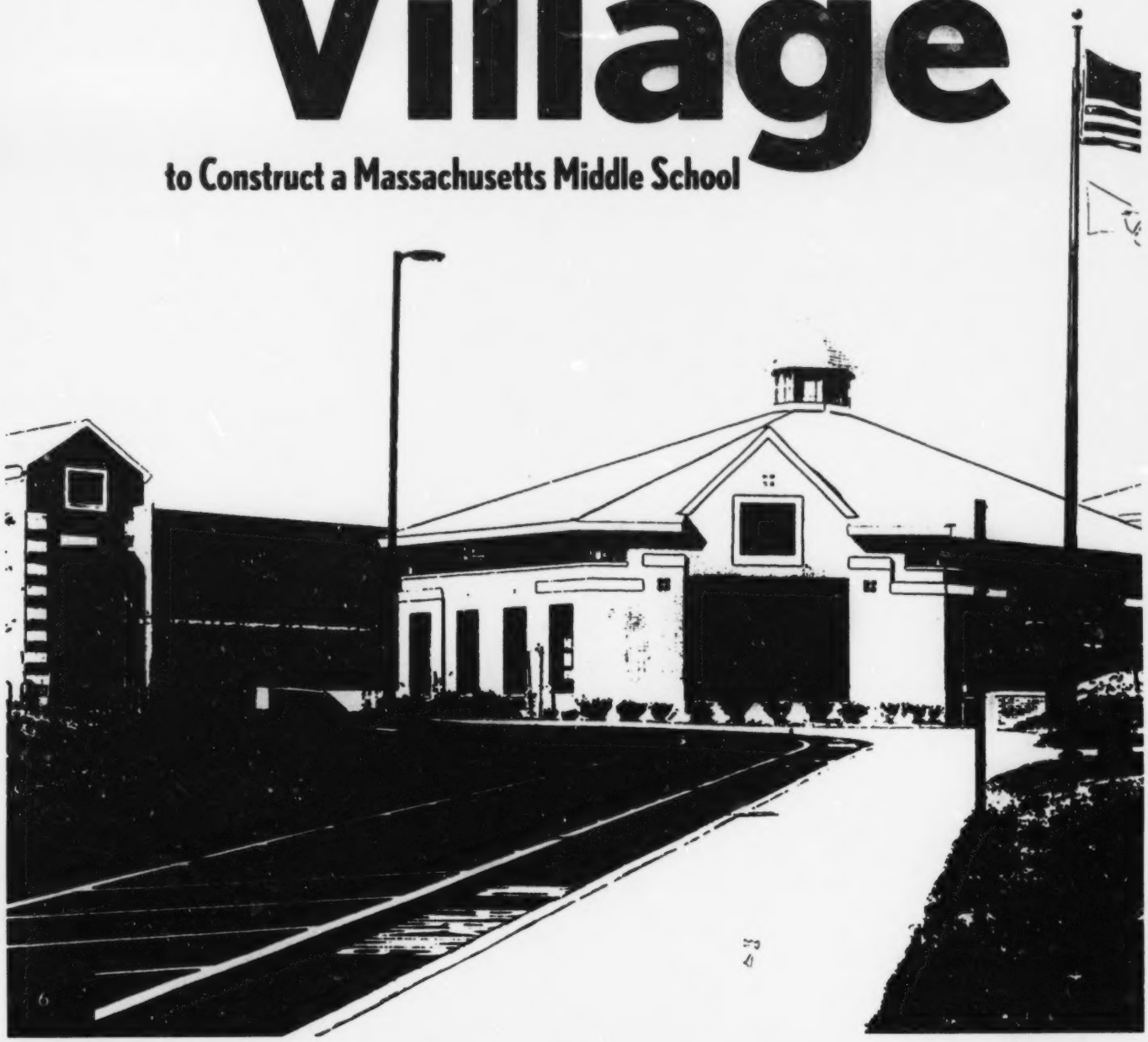
It Takes A Village

to Construct a Massachusetts Middle School

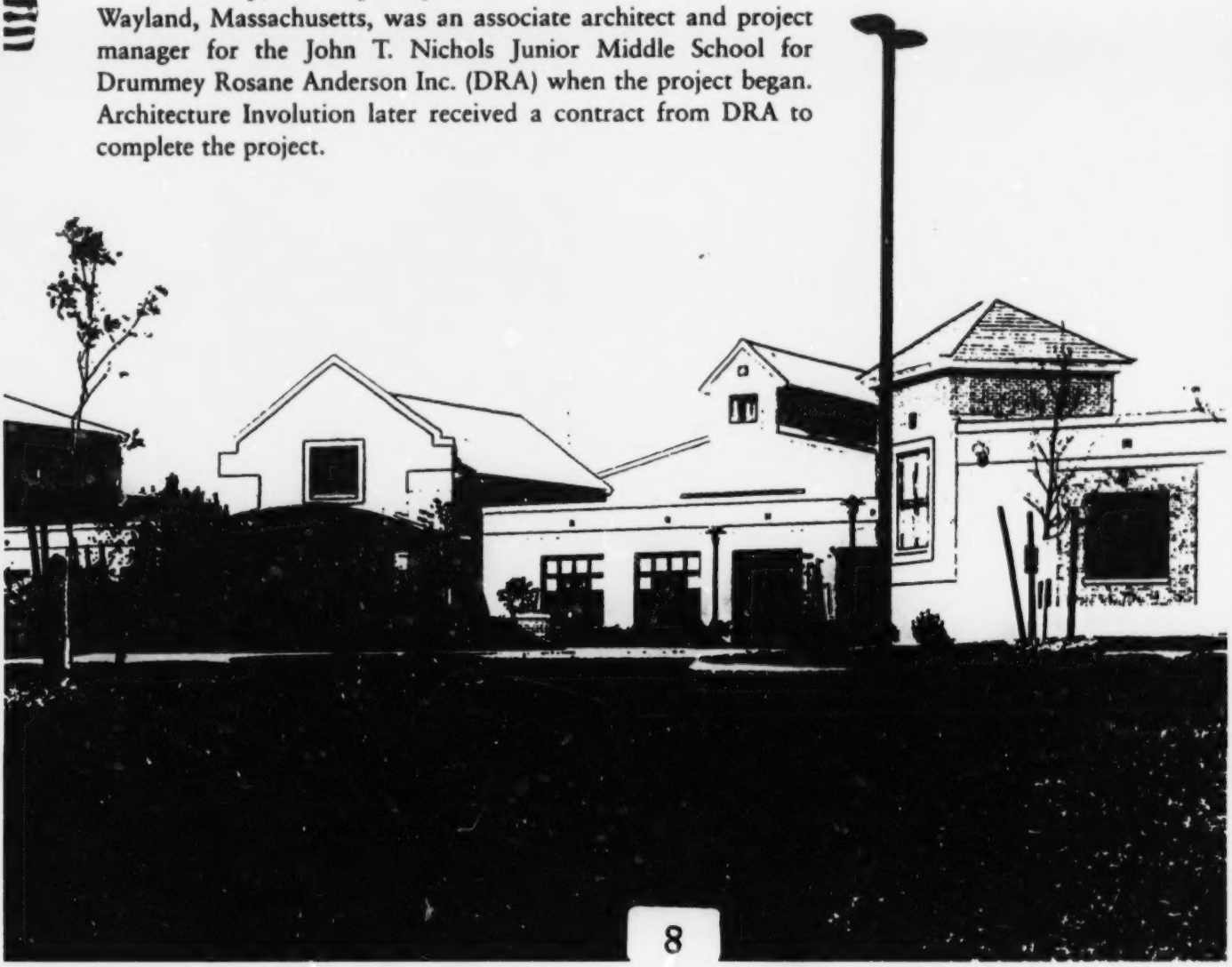


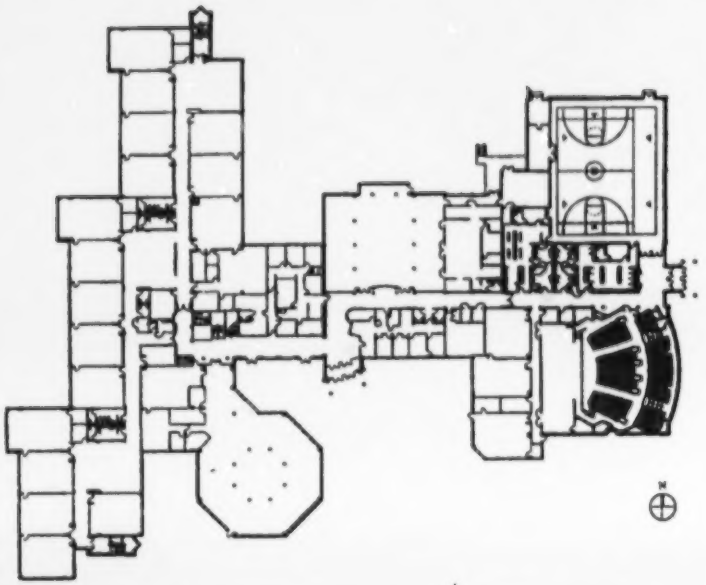
It has been said that "it takes a village to raise a child." Taking that notion literally as well as figuratively were those involved in the design and construction of the John T. Nichols Junior Middle School, located in Middleboro, Massachusetts.

Constructed almost entirely—both inside and out—of concrete masonry, the school, which cost about $17 million to build, was modeled after a typical small New England village.

The school is composed of a cluster of seven main areas, totaling about 150,000 square feet (13,935 square meters) and housing, at full capacity, some 1,100 students. The individual areas include the following: a main entryway; octagonal-shaped library/media center with a glass turret; a three-level classroom wing; a gymnasium; an auditorium; a glass-walled cafeteria that overlooks a scenic forest; and a main stair tower (reminiscent of New England architecture), which helps to reinforce the village concept and also brings in natural light.

Scott Dunlap, now a principal with Architecture Involution in Wayland, Massachusetts, was an associate architect and project manager for the John T. Nichols Junior Middle School for Drummey Rosane Anderson Inc. (DRA) when the project began. Architecture Involution later received a contract from DRA to complete the project.



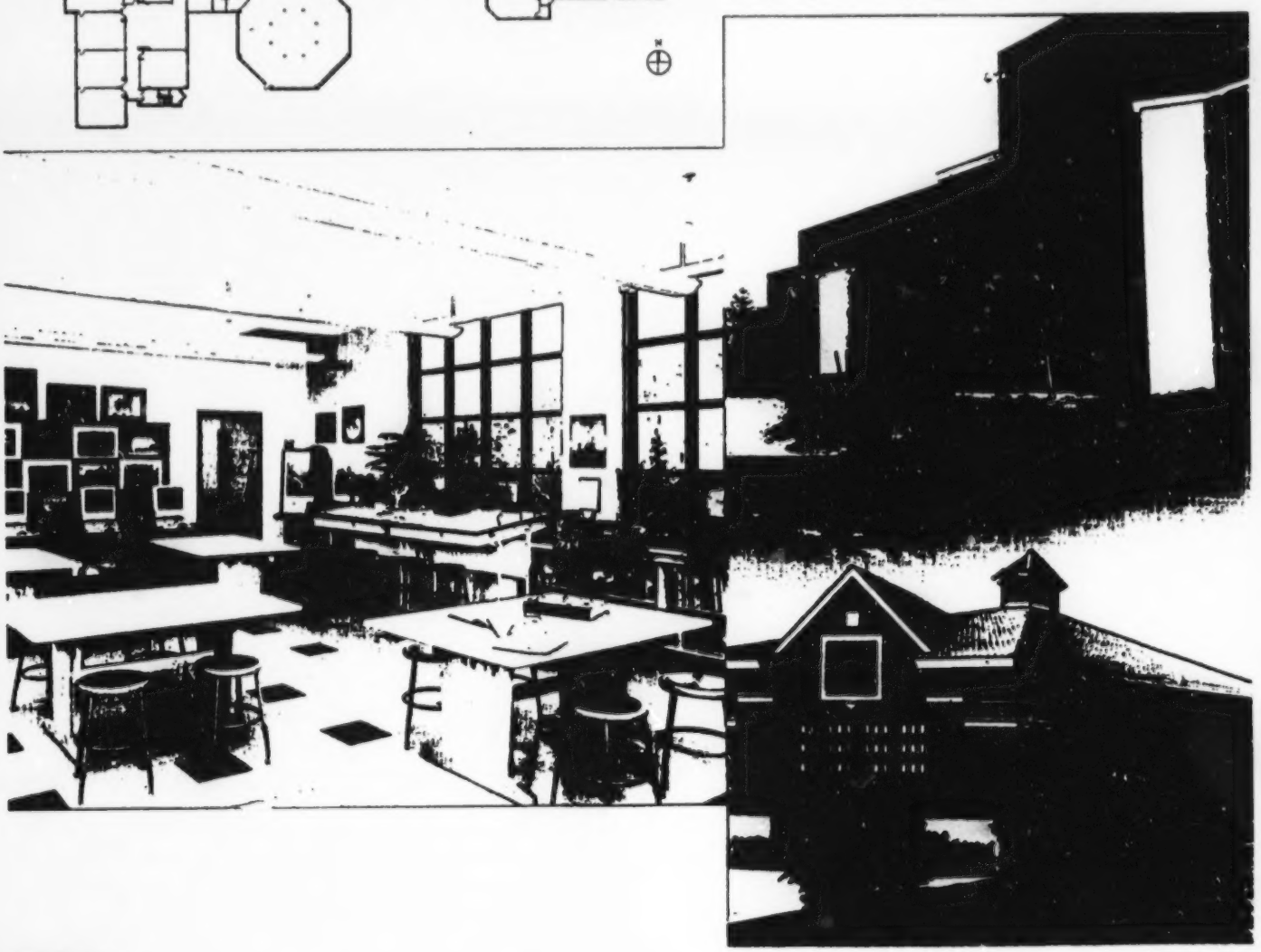


"It was a very large building mass—the largest in Middleboro by far. So when the design process began, we started by trying to break it into smaller pieces. An assemblage of smaller buildings, we believed, would assist in breaking down the scale," said Dunlap.

Completed and ready for occupation by the fall of 1999, all of the school buildings are connected. "It's as if you took seven different buildings and pushed them all together. However, they all have a similar architectural vocabulary that ties them together in a single harmonious composition. They're not linked with corridors; rather, the buildings overlap each other," notes Dunlap.

The variety of colors and textures available in concrete block enabled the designers to easily differentiate the various buildings.

For example, the three-story classroom is unique in that it gives the appearance of only two stories



when viewed from the school's entrance. Taking advantage of the sloped portion of the site, students and faculty enter the school on the middle level, where all core facilities are housed. With the sixth, seventh and eighth grades all located on different levels, students do not have to go up or down more than one flight of stairs in this three-story wing.

The Use of Concrete Block

Why was concrete masonry the product of choice, both on the interior and exterior of the school? According to Dunlap, the design team felt that concrete block was not only the preferred material aesthetically—because of the wide variety of colors and textures available—but also from a durability standpoint.

"Everyone knows that masonry is durable on the exterior of a building," said Dunlap, "but as we go into schools that are 50, 60 and 100 years old, we continually see that when masonry was used on the interior, the walls of the buildings are in much better shape than schools that used plaster or other materials more susceptible to damage."

He adds, "In the last few years, concrete masonry has begun to take on a lot more shapes and forms, colors and textures, allowing designers to use it more frequently for the interior of buildings, as well."

To that end, a variety of colors and textures were used on both the exterior and interior of the school buildings. These include three tones of brick masonry—traditional red brick, dark tan-red brick and a medium beige-to-brown brick—as well as a white split-face block, a crème-colored block and a warm-colored split-face gray block on the base of some of the buildings.

According to Dunlap, "The white split-face block simulates a precast band of concrete, but was much less expensive to install."

He notes that banding was used on numerous buildings to either contrast a very horizontal portion of the building or a very vertical design element that might be adjacent to it.

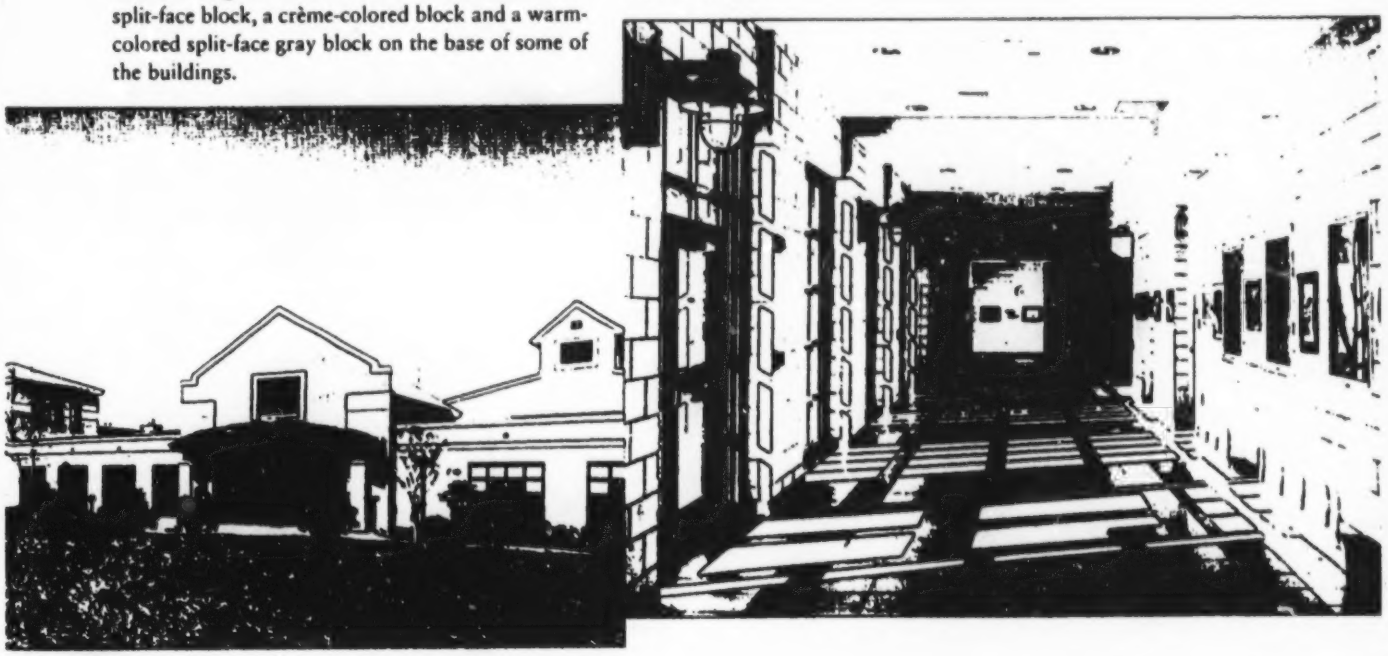
"Or, if we wanted to break down a very tall wall to shorter, horizontal planes, that could be achieved by banding, as well," Dunlap explained.

The sloped roofs on the buildings around the perimeter of the school were constructed with gray, weathered shingles. The majority of the buildings, however, have flat roofs and were constructed using single-ply membrane.

Installation Challenges

What types of design and installation challenges did the construction team face? On the exterior of the buildings, designers decided to employ some shading and shadowing, and some change of plane in the wall surface. This presented interesting installation challenges for the masonry contractor.

Dunlap said, "For example, at the Library/Media Center, we wanted the concrete masonry base to be thicker than the wall above, so when we got above the base, it would be a step back three to four inches (76 to 102 mm) of wall surface. And in some areas around the corners and windows, we wanted to establish a shadow line and a little more detail. We designed the masonry to project back out to create that effect."



Because of the variety of depths available in the concrete units themselves, the use of masonry, unlike any other product, enabled designers to keep the back surface of the wall in the same plane, while at the same time allowing for variations in thickness in the front and sides of the buildings.

According to Dunlap, this was desirable because the designers were trying to maintain the exact cavity depth in the wall in all locations.

"However," he adds, "by using a thicker unit, you can get that projection on the front or outside face of the wall just by changing the size of the module. The added cost of a thicker concrete masonry unit was very small, while the cost to install the units remained the same."

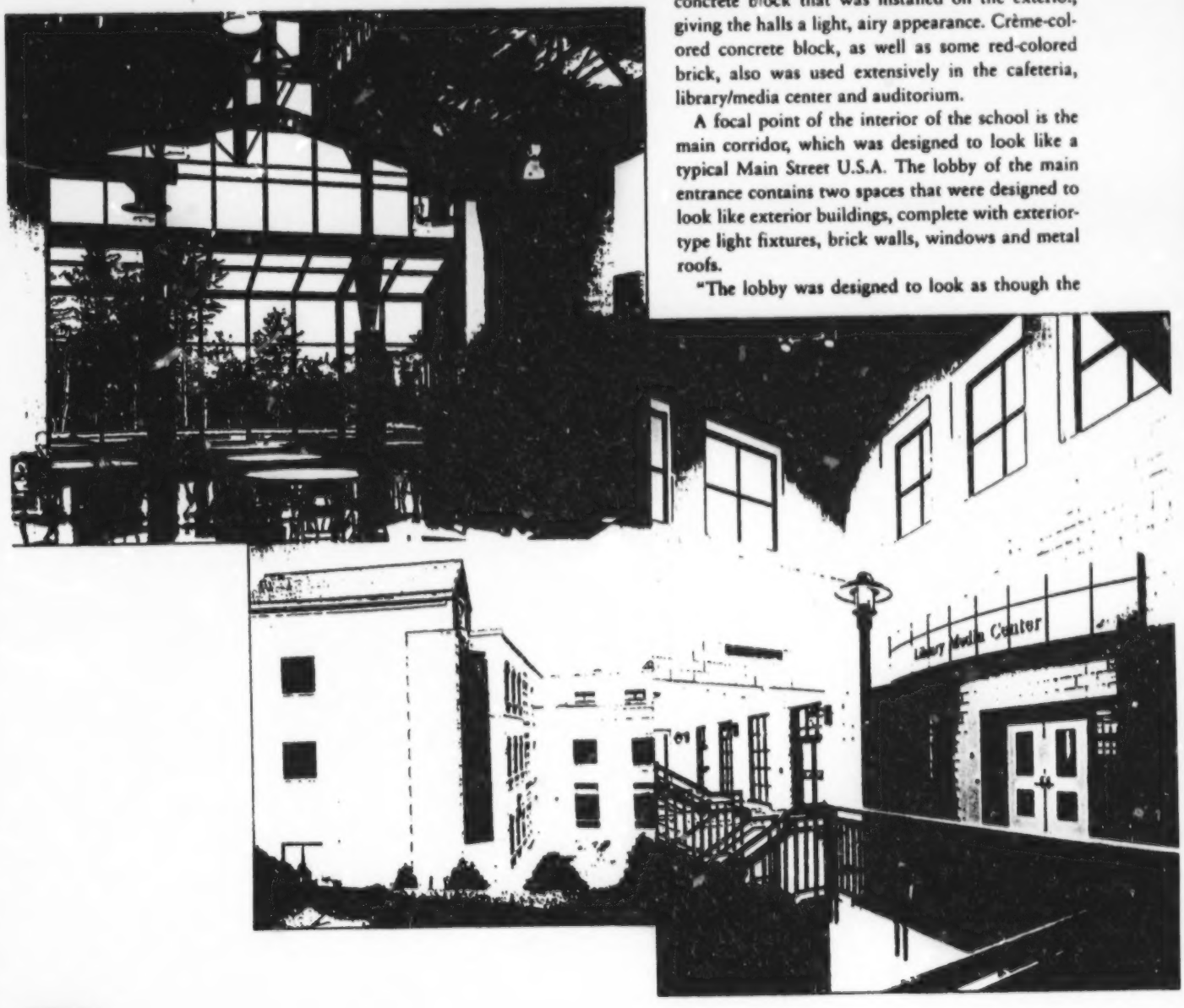
Dunlap noted that constructing the walls with different projections and wall planes turned out to be a real challenge for the masonry contractor. "However, they really seemed to enjoy the challenge. They enjoyed doing this unusual, thought-provoking type of work," he said.

The Interior Masonry Design

Concrete block was used extensively throughout the interior of the school, as well. The corridors, for example, were lined with the same crème-colored concrete block that was installed on the exterior, giving the halls a light, airy appearance. Crème-colored concrete block, as well as some red-colored brick, also was used extensively in the cafeteria, library/media center and auditorium.

A focal point of the interior of the school is the main corridor, which was designed to look like a typical Main Street U.S.A. The lobby of the main entrance contains two spaces that were designed to look like exterior buildings, complete with exterior-type light fixtures, brick walls, windows and metal roofs.

"The lobby was designed to look as though the



exterior village concept was continued inside the school and down toward the library/media center," said Dunlap.

He noted that initially, the design team considered using some of the newer drywall products, such as some of the impact-resistant drywall products and impact-resistant, fiberglass-coated drywall panels that have been gaining popularity.

"But in the end," Dunlap explained, "when you have to finish the joints of all of those panels and reinforce the corners to give it a clean, durable look, it can't stand up to the same kind of abuse that the concrete masonry can."

One of the things that made masonry an acceptable product on the inside was the fact that only naturally colored concrete block was used. The block was not painted, as is often the case in other schools.

"Once you put a block in the wall and put a coat of paint over it, it could be almost any material, because it has lost its true color and texture," said Dunlap.

He added, "There was a concern going into the project that students might damage the natural block by marking or painting on it, but it's a testament to the respect that the students have for the school that it has received almost no damage over the past two years. It looks today like it did when they opened the building in the fall of 1999."

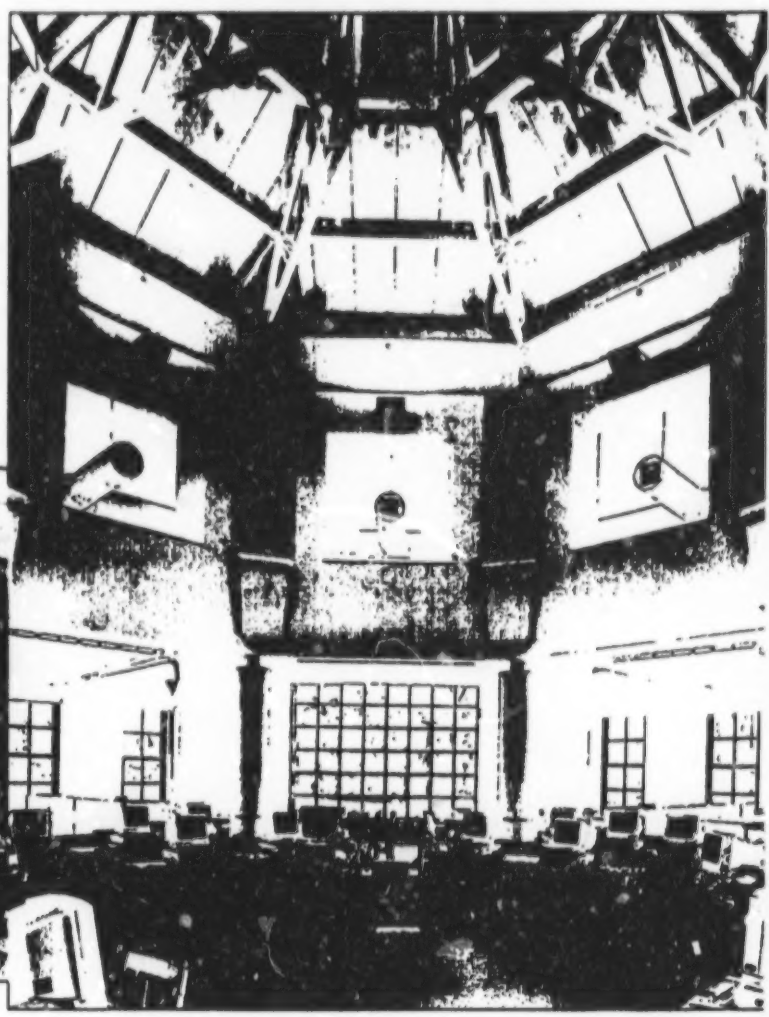
Community Feedback

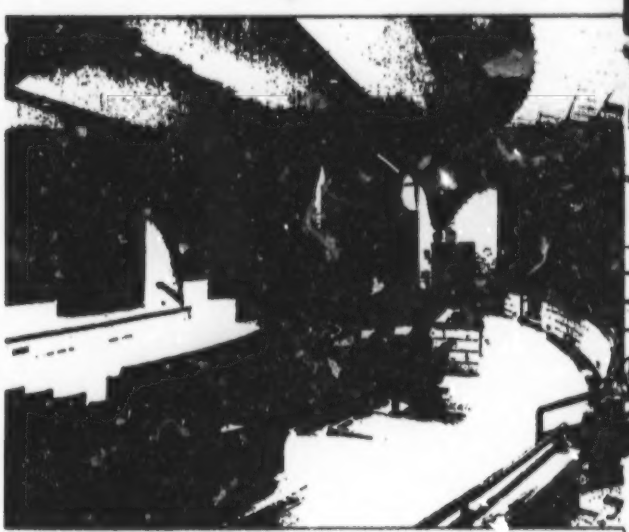
The feedback from the town's building committee has been overwhelmingly positive. According to Alan Lindsay, chairman of the Middleboro Building Committee, "Everyone in town is thrilled with the school, and with its physical resemblance to the town of Middleboro. In fact, the project has received overwhelming support from *all* of the town's committees and community leaders."

He noted that not only are town leaders thrilled with the appearance of the new school, but with the fact that the project came in some $1.8 million under budget and was completed in only 18 months.

"The concrete masonry was supplied by a local company. As a town resident, the owner took a special interest in the project and was able to give us a very good price on high-quality block," said Lindsay.

Adds Dunlap, "This is the best project we've ever been involved with. The town embraced it both conceptually and design-wise from the very start. It's one of the few buildings I've worked on where there was no criticism waged whatsoever before, during or after the school was completed." ■





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Lessons Learned

When used in school design, concrete block always goes to the head of the class.

It's time for a pop quiz. When architects choose concrete block as a primary material in their school designs, they do so because CMU is—

☐ **A.** Durable
☐ **B.** Versatile
☐ **C.** Cost effective
☐ **D.** Low-maintenance
☐ **E.** All of the above, and more.

If you answered "E," it probably won't surprise you to learn that block was the correct answer for facilities as different as a middle school in suburban Chicago, a small-town high school on Cape Cod, a built-from-scratch urban high school in St. Paul and an elementary school in the New Mexico desert. Concrete masonry, architects have learned, never misses a day of school, can readily adapt to the needs of a design and can take whatever students dish out.

"Block stands up to abuse," agrees Gaylaird Christopher, principal-in-charge for Perkins & Will Architectual, a 66-year-old national design firm specializing in school design. Adds another Perkins & Will architect, "It's not easy to find a material that can match it."

A School Building That Teaches

Concrete masonry units' (CMUs) toughness and longevity were on Christopher's mind while designing Jewel Middle School, a 120,000-square-foot (11,148-square-meter), single-story institution in Aurora, Illinois, outside Chicago.

"Masonry is used throughout the building," he says. "What we were trying to do is get an aesthetic in a public building that is strong and long-lasting and requires little maintenance."

Built for 1,000 students, Jewel opened in 1999, at a cost of $13 million. "It's a fairly economical building—a little over a hundred dollars a square foot," Christopher says.

And it was built to last, says Sherry Eagle, superintendent for West Aurora School District 129. "Our schools in this district last a long time. We have three schools more than 100 years of age. It was clear that materials used in this school would have to stand the test of time," she says.

The structure was built of steel and masonry, with some of the masonry being loadbearing. The exterior is largely brick veneer. The goal of the design was to separate the sixth, seventh and eighth grades and break down the institutional feeling that can overwhelm students, Christopher says. "The main idea is to make it a more personal space. That's the whole idea behind middle schools."

So Jewel Middle School is divided into three clusters, one for each grade. A horseshoe-shaped atrium acts as the school's hub, from which each cluster can be accessed.

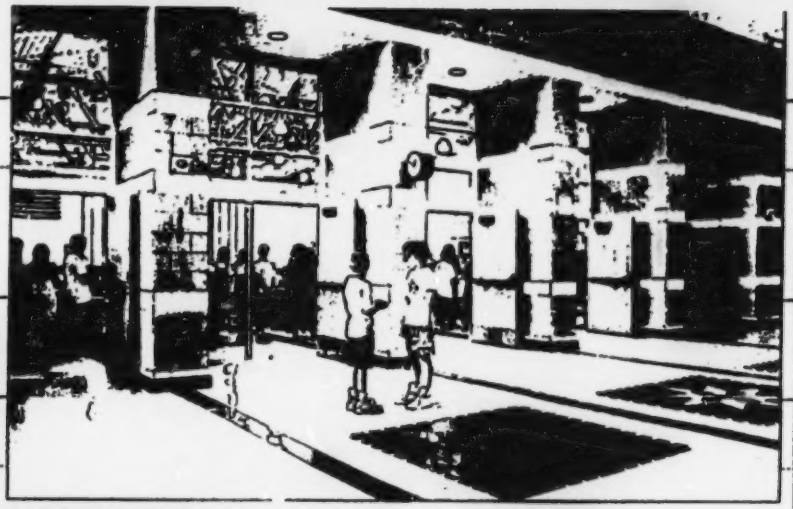
"No matter who walks into this school, everyone is overwhelmed—because it's striking," Eagle says. "The block brings warmth to the building. It's welcoming, not cold and sterile."

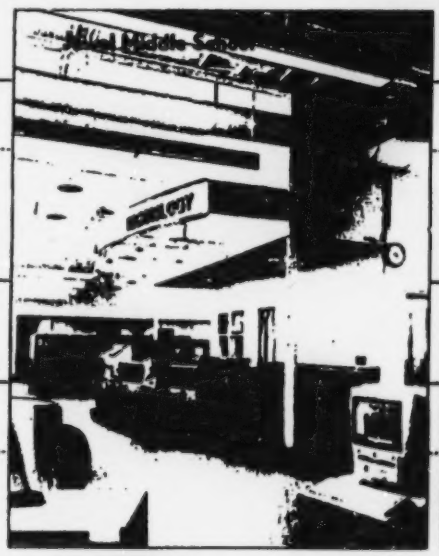
"Pretty much all the public spaces are exposed concrete block," Christopher says. That includes the atrium, gymnasium and multi-purpose spaces. The block is exposed, "lightly sandblasted to reinforce the naturalness of the material," he adds.

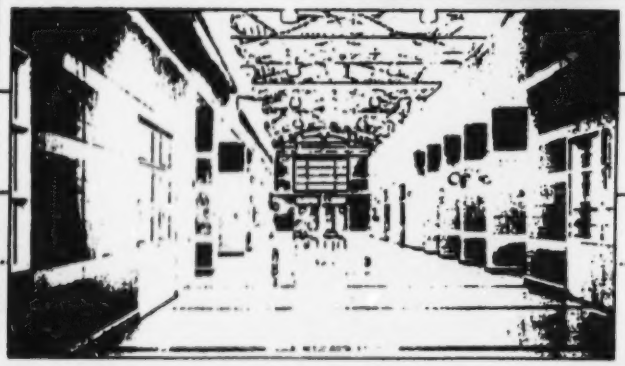
"A regular concrete block can have a mottled look to it. Sandblasting brings out the aggregate in the block and makes it look more finished, like a burnished block."

The design uses colored block—"tan, with a little red in it," Christopher says—and includes bands of lighter-colored, gray-tone block. The effect "adds warmth and texture on the interior walls," he explains.

Most walls are composed of standard 8" × 8" × 16" (203

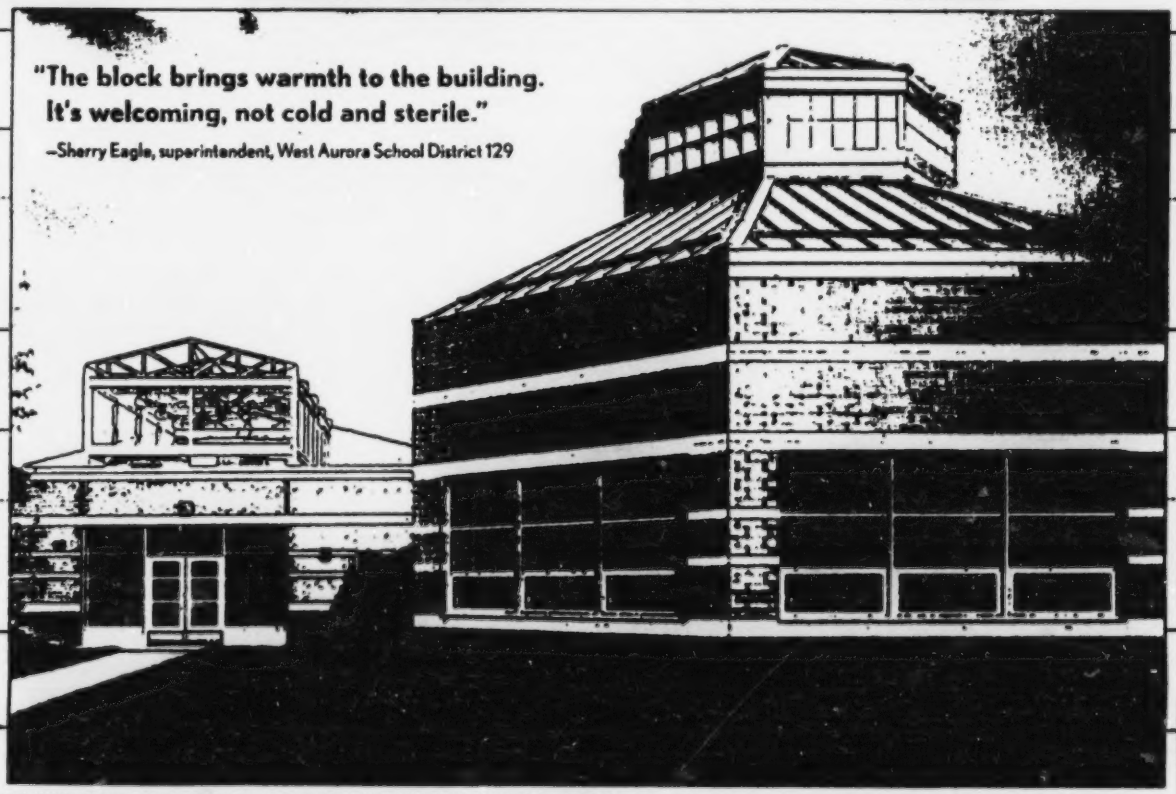






"The block brings warmth to the building. It's welcoming, not cold and sterile."

–Sherry Eagle, superintendent, West Aurora School District 129



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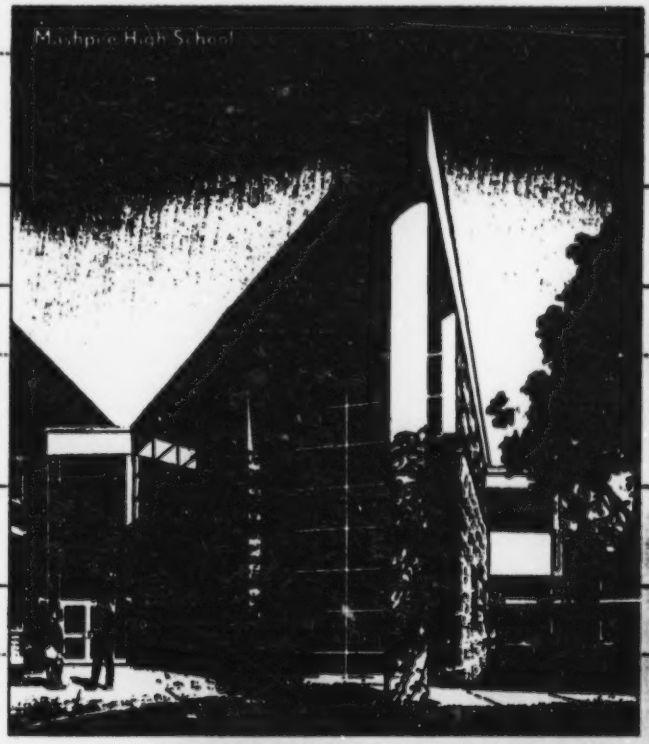
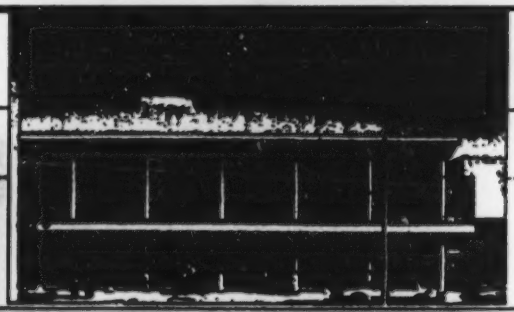
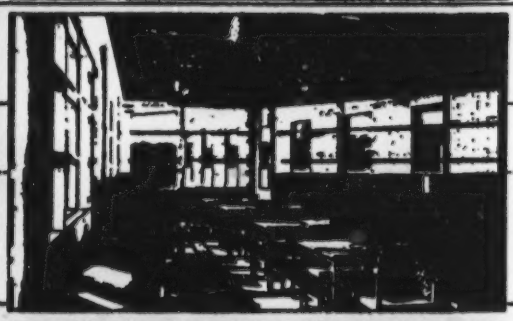
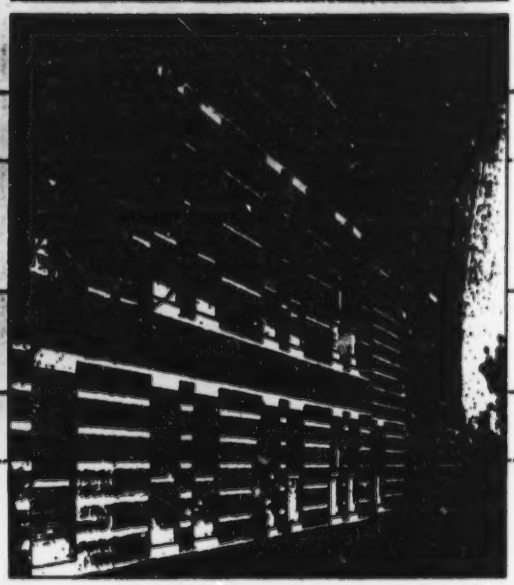
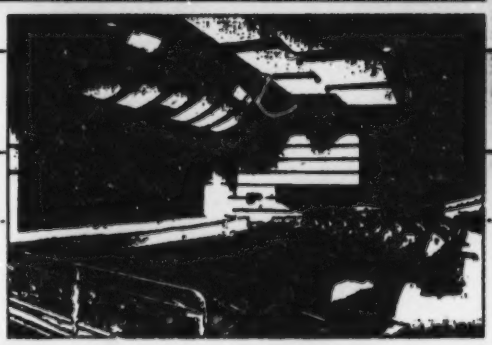










mm x 203 mm x 406 mm) block. Some of the banding is 4-inch (102 mm) block, while 12-inch (305 mm) block is used in the gym. The CMUs are reinforced with steel rebars and "in a few cases pilasters provide major support," Christopher says.

Concrete masonry was the economical choice at Jewel because it can pull double duty, he says. "The same material that we use structurally we can use as a finish material."

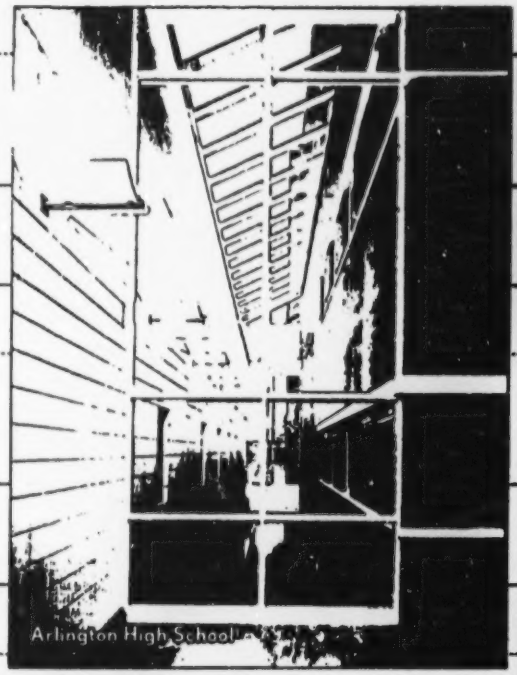
And by exposing the block, the material becomes a teaching tool, Christopher says. "We try to show the students how the building is held up. If you have a masonry pilaster with a steel beam on top of it, students can see it. There's a push in education to make learning more real, and what can be more real than the environment they're in?"

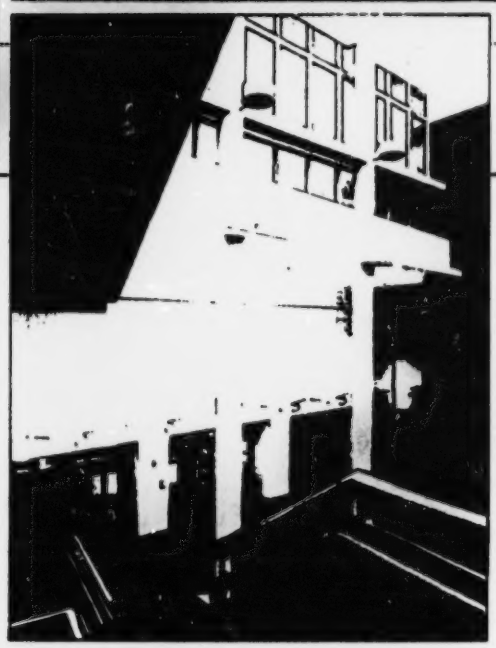
"With block you can use a bearing system and a It was the right cost and the right material."

History Lesson

Every student learns the story of the first Thanksgiving, of the Pilgrim colonists who landed at Plymouth in 1620 and the Native Americans who helped them survive the first harsh winters. At Mashpee High School, not far from Plymouth, on the southwest end of Cape Cod, a reminder of that history lesson was built into the school structure.

The designers call it "the canoe," a pointed extension of the roof that recalls the Wampanoag nation that met the Pilgrims, and whose descendants deed-



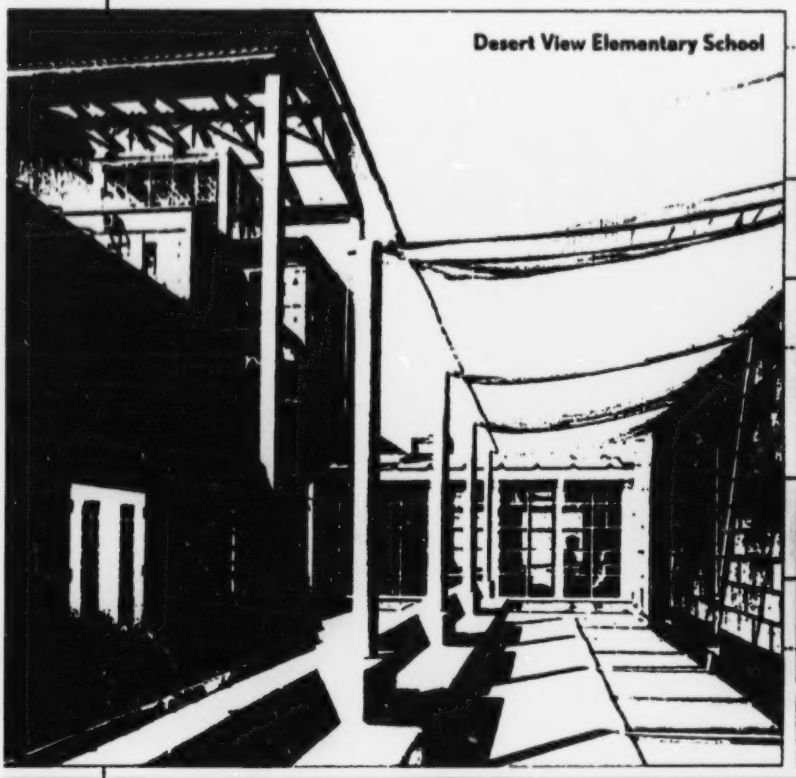


nish system and get the economy of dual use.

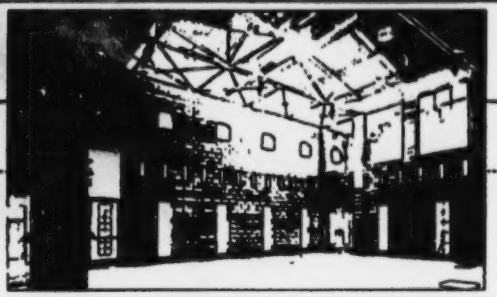
–Ray Bordwell, principal, Perkins & Will

ed the land to the town of Mashpee to build the high school, according to Ray Bordwell, principal with Perkins & Will.

Carved out of wooded land, Mashpee High School was completed in 1997 at a cost of $16 million—under budget, Bordwell says. At 183,000 square feet (16,723 square meters), the price of construction was $87 per square foot. The two-story structure was designed to serve 1,100 students as well as the 13,000-strong Mashpee local community. (This design includes a full complement



Desert View Elementary School



of sporting facilities for community use.)

The influence of concrete masonry on the school is just as palpable as that of the Wampanoags, or the Cape Cod aesthetic, which can be seen in the use of clapboard in several areas of the exterior. Bordwell says CMU was chosen for both its flexibility and its thermal mass, which helps keep the cold out and the heat in during the blustery winters on the cape.

Mashpee High School was built using a CMU loadbearing wall system. The exterior wall combines brick and split-face block to provide striping. The cavity between the exterior and interior walls is filled with rigid insulating foam. Rebar and grouting reinforce the standard-sized blocks.

"With block you can use a bearing system and a finish system and get the economy of dual use," Bordwell says. "It was the right cost and the right material."

The New School in Town

For decades now, the sprawling suburban Mashpee High School has been the prototype for all new construction. So when the city of St. Paul, Minnesota, decided to build its first brand-new intown high school since the 1920s, designers had to figure a way to make that prototype fit into a tight urban setting.

As a result, Arlington High School "is a denser, taller version of a modern-day high school ... on a campus roughly one-fifth the size of schools built in surrounding suburbs," the local City Business wrote before the school's 1996 opening.

Built on 29 acres (11.7 hectares) at a cost of $52 million, Arlington covers 368,000 square feet (34,188 square meters) and accommodates 2,000 students. Despite the added costs of land acquisition and extensive site preparation, the school district was happy to foot a bill of little more than $102 per square foot.

Extensive use of concrete masonry helped keep costs down. At Arlington, 8-inch (203 mm) CMUs "act as a backup for the brick exterior wall," says Jerry Johnson, design principal at Perkins & Will. The block doubles as the interior wall, painted white or off-white. The cavity between the brick veneer and block wall is filled with two inches (51 mm) of rigid insulation foam. A steel skeleton carries the weight of the floor and roof.

Although the school is four stories high, because it is built on a bluff, "it is never more than three stories high above the ground," Johnson says.

The design "reflects the topography and St. Paul's role as a river town," he continues. One side of the building—the public side containing the administra-

tion offices, great hall and resource centers—has a soft, curving façade, like the edge of a river. The other side, which contains the four "houses" with classrooms, "is rectilinear, like a bluff or rocky outcrop that symbolizes the rock around the river," Johnson says.

He calls Arlington's concrete masonry-lined great hall "one of the most interesting things about the school." In the spirit of the old cafatorium, designers eschewed an auditorium (the most expensive part of a school design, Johnson says) in favor of a hall that could serve both as an eating and performance space. "It's almost like a nightclub type of thing, with different floor levels that produce better sight lines."

But block does its most important work in the common areas—hallways, toilet rooms and locker rooms—where the effects of raging hormones and ordinary wear are felt the most. "It's hard to break it or mar it, and it's easy to paint," Johnson says.

"A lot of schools are going to metal studs and drywall because it's more economical," he adds. "We feel that concrete block is the best to use."

The school's principal, Bill Dunn, will testify to that. The third and fourth floor hallways were lined with drywall "to save a couple bucks," he says. "It can get beat up pretty badly by kids."

The outside corners of these walls have been damaged just by normal traffic and recently received protection by the installation of 278 aluminum covers. "I learned more about aluminum covers on Sheetrock than I should," Dunn laughs. "With the block it's not an issue at all."

Growth Spurt

Sunland Park, New Mexico, was an isolated town a half-mile from the Mexican border when Desert View Elementary School first opened its doors there in 1988. Today, with the explosive growth of El Paso, Texas, not far down the Rio Grande, Sunland Park finds itself part of a thriving metropolitan area. Desert View, built with single-wythe loadbearing concrete block walls, is up to the challenge.

"It's in great shape," says Alfredo Holguin, physical plant director for the Gadsden Independent School District. "Probably no different than when they built it."

Reflecting what Perkins & Will Design Principal Ralph Johnson (no relation to Jerry Johnson) calls the region's "simple structures, using real simple materials," Desert View's masonry walls are topped with sloped metal roofs.

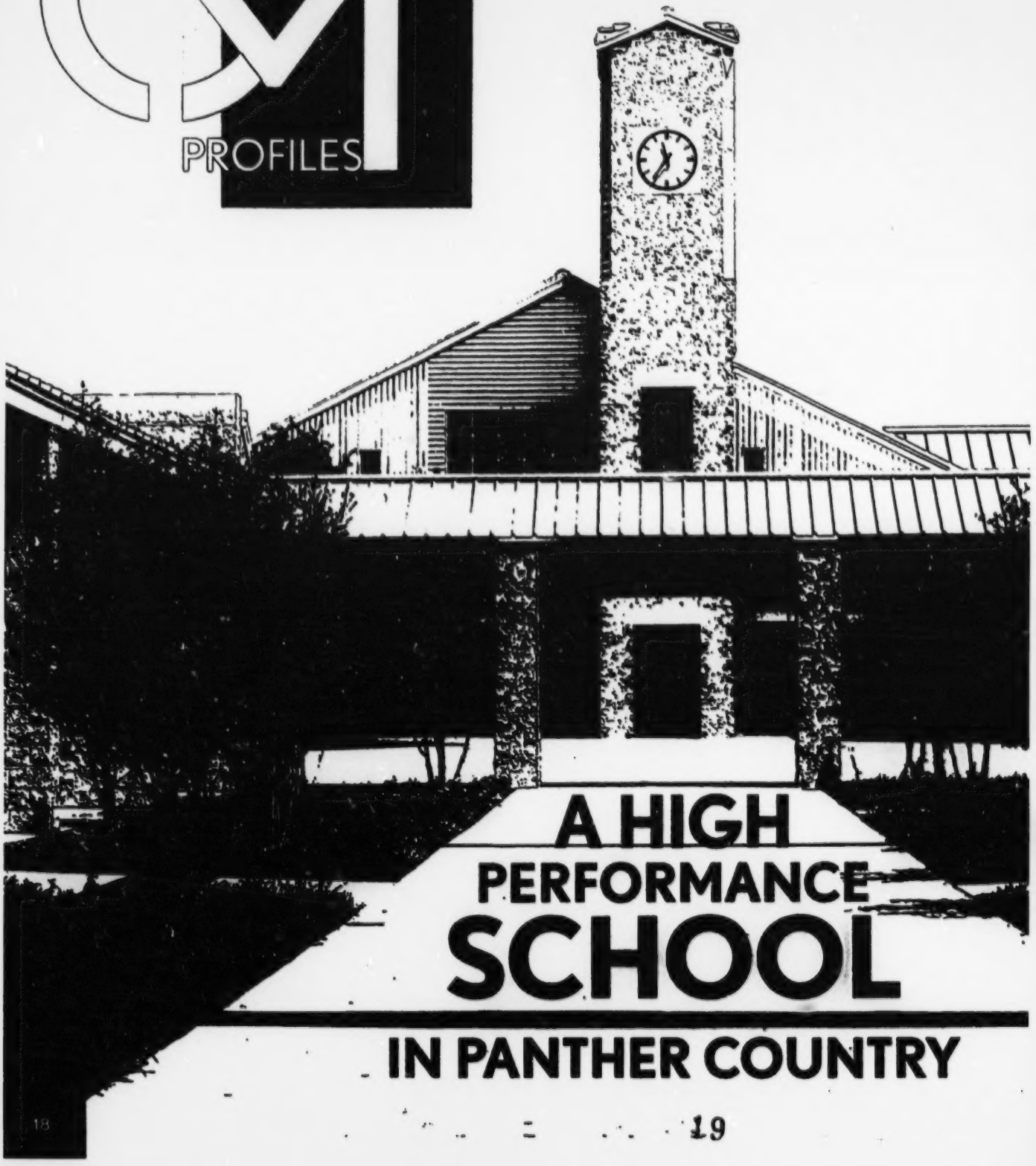
The 8" × 8" × 16" (203 mm × 203 mm × 406 mm) integral colored blocks are tan, some with red accents, others with whitish accents, Johnson says. The walls are filled with rebars or insulation.

The 44,000-square-foot (4,088-square-meter) structure was build for 600 students. At $3.1 million, or about $70 per square foot, "we were on a very tight budget," he says. "So concrete masonry was the appropriate choice in allowing us to meet our budget and use colors. It's very economical."

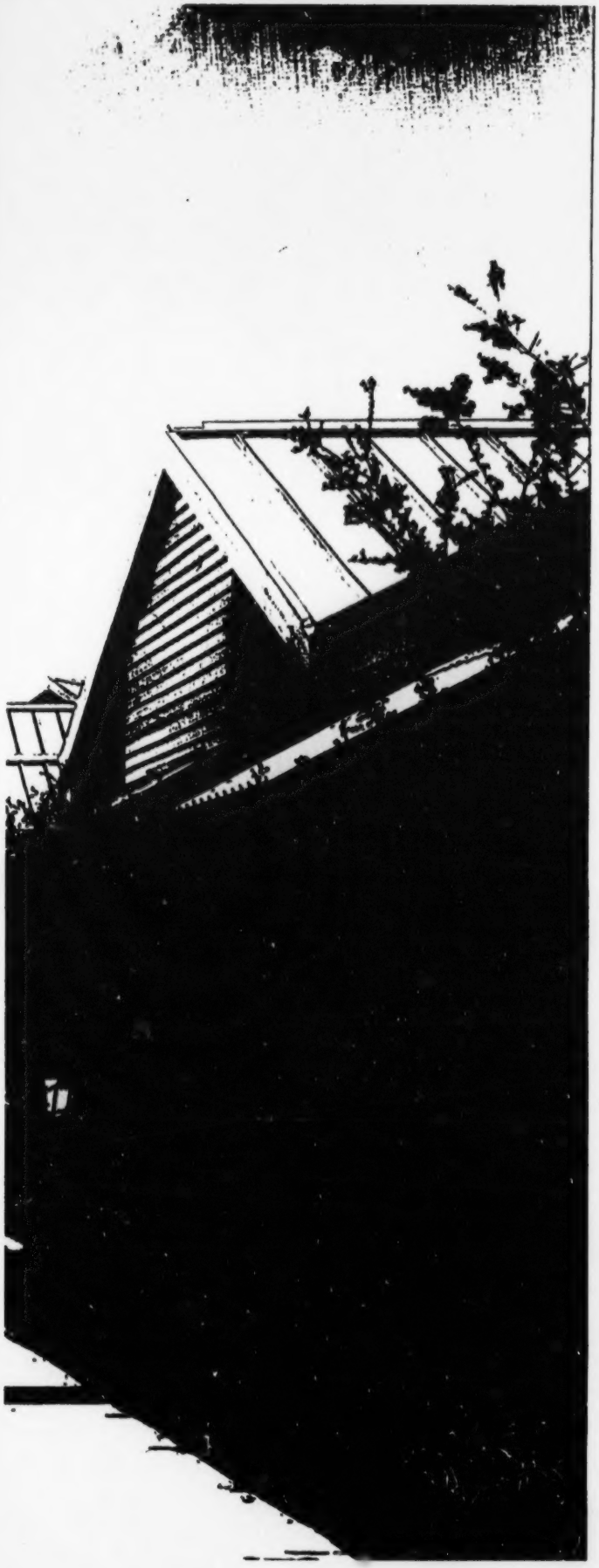
Despite the budget squeeze, Desert View won an American Institute of Architects National Honor Award.

For that, no doubt—and for its flexibility, durability and cost effectiveness—concrete masonry deserves extra credit. ■

PROFILES



A HIGH PERFORMANCE SCHOOL IN PANTHER COUNTRY



THE PANTHERS OF THE SANDRA DAY O'Connor High School in the Northside Independent School District (NISD) are a proud and dedicated campus community. They reflect a high performance attitude in all of their programs and activities. According to Ken Patranella, principal at Sandra Day O'Connor High School, the school is only three years old, but has already begun to build a tradition of success.

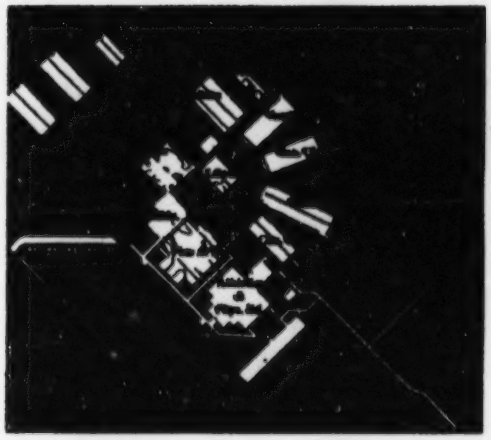
In the last two years, the Sandra Day O'Connor High School has been honored by the Texas Education Association (TEA) as a "Recognized High School." Among the students at Sandra Day O'Connor, high performance has caught on with four National Merit Scholars and over $2.8 million in scholarships awarded within their most recent graduation class of 530 seniors.

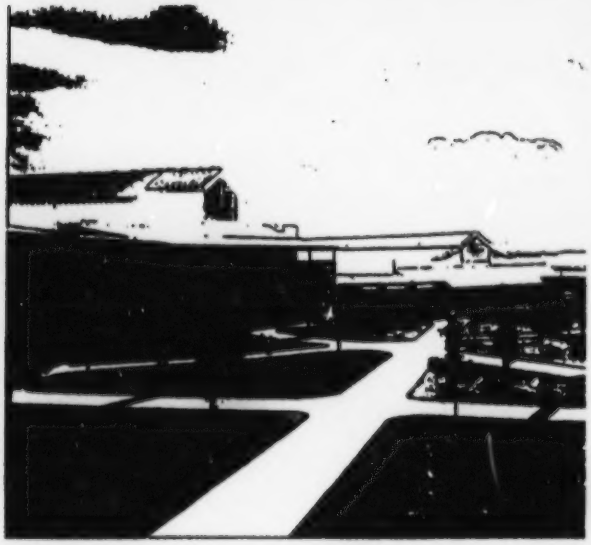
This high performance perspective is not surprising, though, as the project from its inception has been characterized by a commitment to seeking excellence. Bill Reeves, AIA, a prinicipal at Marmon Mok, the design and engineering firm responsible for Sandra Day O'Connor High School, reported that NISD is one of the largest school districts in the State of Texas with over 65,000 students within its borders. At that scale and with growth driving an extensive construction plan into the future, the school district has developed a comprehensive design guide, which provides a number of requirements that are on the edge of current thinking in school building development.

While Sandra Day O'Connor High School is part of a fast-growing and largely suburban school district, it is also on the far reaches of the district, and its location sits adjacent to the small Texas farm community of Helotes with a population of just over 2000. From the earliest meetings with the school district personnel, Reeves and his colleagues at Marmon Mok had the objective of designing a school for a student population of 3000 and blending it seamlessly with a small rural community situated within the fabled Texas Hill Country. Reeves began to look for a design consistent in scale and appearance with the many farm buildings dotting the countryside.

This design direction and the well-developed guidelines provided by the school district led the team at Marmon Mok to a combination of single- and two-story buildings with the appearance of local limestone and metal roof structures that predominate the area. There were also specific requirements for an overall economical design that provided a durable, easily maintained structure utilizing materials that would be readily available in the event that a subsequent expansion were required.

From the earliest stages, Reeves considered split-face concrete masonry to be a viable option for the exterior of these





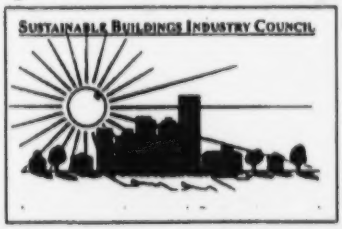
buildings. However, as he worked through the project details, it became clear that the widespread use of concrete masonry was in fact the right choice in many ways for the wall systems for both the interior and exterior of the buildings.

Working within the strict budget provided by the school district would be a challenge. However, Reeves and Marmon Mok succeeded with their design for the Sandra Day O'Connor High School and delivered a project with a completed construction cost of $87.00 per square foot. Even with such an extensive use of concrete masonry, these wall systems contributed only $6.36 per square foot.

Alternate materials were certainly possible, but not widely considered by Marmon Mok. An exterior insulating finishing system (EIFS) might have provided a small savings when compared with concrete masonry, however, it would never meet the school district standards for durability or the design objectives. Other systems such as architectural pre-

■ BUILDING BLOCKS

The Sustainable Buildings Industry Council working in cooperation with the U.S. Department of Energy have developed a Resource and Strategy Guide for the design of High Performance School Buildings. These "16 Building Blocks" are the key systems and technologies that, when considered wholly, result in a finished school that is an enduring asset to its community—enhancing teaching and learning, reducing operating costs and protecting the environment. The guidelines, prepared by the Northside Independent School District, although distinct, share many common concepts as illustrated through their employment in the Sandra Day O'Connor High School.



■ **Acoustic Comfort**–Students and teachers can hear one another without shouting. Noise from inside and outside the classroom is minimized.

■ **Commissioning**–The school operates in accordance with design intent and meets the needs of the owner. This is made possible by implementing a formal commissioning process—a kind of 'systems check' for the facility. The process tests, verifies and fine-tunes the performance of key building systems so that they perform at the highest levels of efficiency.

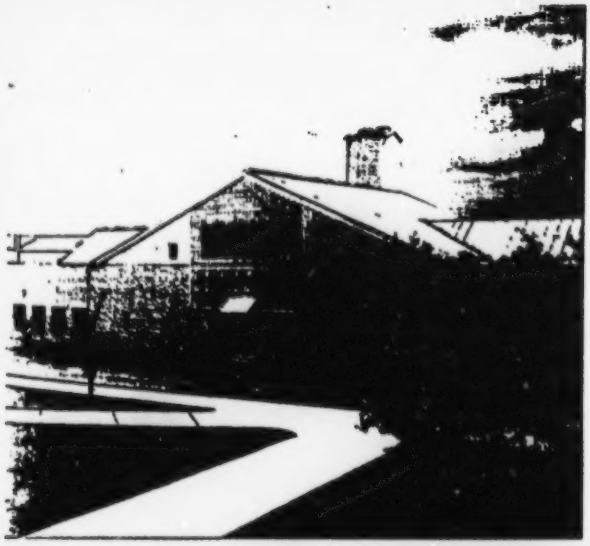
■ **Daylighting**–As much natural daylight as cost-effectively possible is provided, particularly in classrooms where it can do the most good. Daylighting systems are designed to avoid excessive heat loss or gain and to minimize glare.

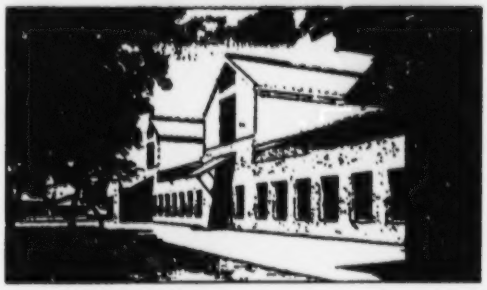
■ **Energy Analysis Tools**–The facility is designed to reduce short- and long-term energy costs as much as possible while maintaining a high-quality learning environment. Energy analysis tools are used to predict the energy impacts of alternative design strategies and to select the best combinations of quality and energy efficiency.

■ **Energy Efficient Building Shell**–The walls, floors, roofs and windows of the school are as energy efficient as economically practicable. The building shell integrates and optimizes insulation levels, glazing, shading, thermal mass, air leakage and light-colored exterior surfaces.

■ **Environmentally Preferable Materials and Products**–To the maximum extent possible, the school incorporates materials and products that are durable, non-toxic, derived from sustainable-yield processes, high in recycled content and easily recycled themselves.

■ **Environmentally Responsive Site Planning**–To the extent possible, the





cast that might have been considered for the building envelope was known to have been more expensive and would not fulfill the design concept developed by Marmon Mok for the project.

To blend with the scale of the community, the school was segmented into a number of individual buildings all entering into a common courtyard which included a separate library building and connected around the perimeter by a metal clad covered walkway. This was considered a "Village Concept" and quickly embraced by Principal Ken Patranella. Each individual building incorporated a pre-engineered steel frame structure and used a double-wythe concrete masonry wall for the building enclosure. These walls were composed from a four-inch (102-mm) split-face concrete masonry veneer and an eight-inch (203-mm) concrete masonry interior wythe, separated by air space and ½-inch (12.7-mm) insulation board. This design provided an excellent basis for an energy-efficient building shell as required by the school district.

When the choice of materials for interior walls was considered, again concrete masonry became the preferred solution. All of the corridor walls and circulation areas were designed using a single-wythe

school's site conserves existing natural areas and restores damaged ones, minimizes stormwater runoff and controls erosion, and enhances the building's high performance features.

■ **High Performance HVAC**–The school's heating/ventilating/air conditioning (HVAC) system uses high efficiency equipment and is 'right sized' for the estimated demands of the facility and includes controls that boost system performance.

■ **High Performance Electric Lighting**–Students and teachers work in a high quality visual environment that stimulates learning while saving energy. The school's lighting system uses high efficiency lamps and ballasts, optimizes the number of light fixtures in each room, incorporates controls that ensure peak system performance and successfully integrates electric lighting and daylighting strategies.

□ **Life Cycle Cost Analysis**–The school is optimized with a view toward its total cost of ownership over time. Initial, operating, and maintenance/repair/replacement costs are compared for numerous design alternatives using a life cycle cost analysis tool or tools. The best combination of quality and long-term cost effectiveness is selected.

■ **Renewable Energy**–The school maximizes the cost-effective use of renewable systems to meet its energy needs. During the design process, the following systems are systematically evaluated and considered: passive solar heating, solar hot water, active solar (for space heating), geothermal heat pumps, natural ventilation, wind-generated electricity, photovoltaically generated electricity and green power.

■ **Safety and Security**–Students and teachers feel safe anywhere in the building or on the grounds. A secure environment is created primarily by design: opportunities for natural surveillance are optimized, a sense of territoriality is reinforced and access is controlled. Security technology is used to enhance, rather than substitute for, the design features.

■ **Superior Indoor Air Quality**–Students and teachers suffer no ill effects from the air inside the school. Sources of contamination are controlled, adequate ventilation is provided and moisture accumulation is prevented.

■ **Thermal Comfort**–Occupants are comfortable at all times. Temperature and humidity remain in the 'comfort zone.' Hot, stuffy rooms and cold, drafty ones are eliminated. Teachers have control over thermal conditions in individual classrooms.

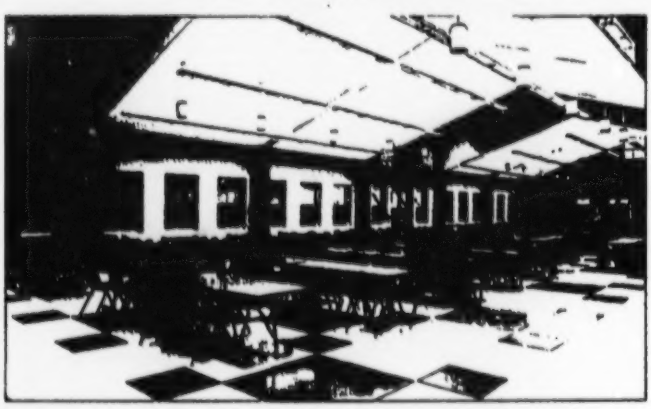
■ **Water Efficiency**–The school uses as little off-site water as possible to meet its needs. The school controls and reduces water runoff from its site, consumes fresh water as efficiently as possible, and recovers and reuses graywater to the extent feasible.

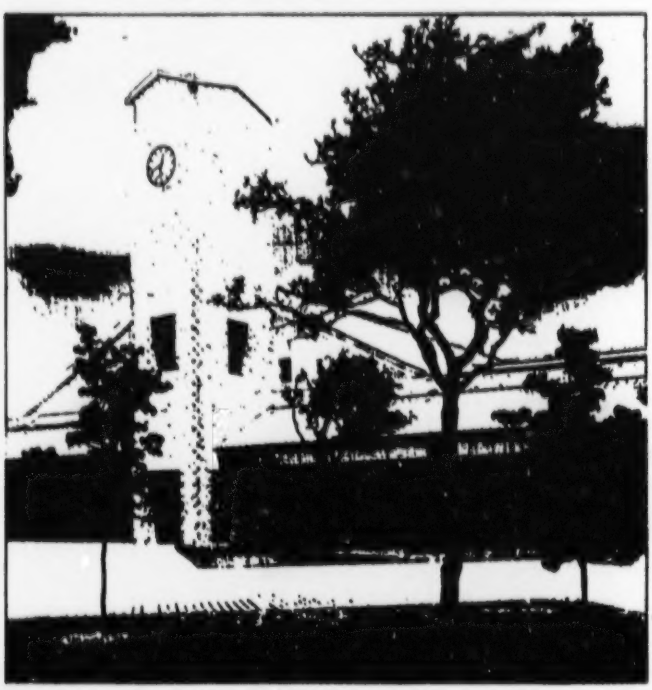
For more information on high performance schools contact the Sustainable Buildings Industry Council at www.sbicouncil.org or 202-628-7400.

eight-inch (203-mm) concrete masonry unit of various types. The demising walls for each classroom were also designed in the same manner. This extensive use of interior concrete masonry insured that the overall school design met the life cycle cost criteria established in the school district design guidance. Additionally, these same heavy massive walls provided a clear contribution to the thermal comfort of the building and enhanced the performance of the HVAC system. The corridor and demising walls also contributed to a superior indoor air quality, not contributing any volatile components to the environment or providing a source for collection of dust and other contaminants.

Another major contribution from concrete masonry to the high performance nature of Sandra Day O'Connor High School came in considering the acoustical design of the buildings. With the classrooms surrounded by concrete masonry, students and teachers were not impacted by noise from adjoining areas. In some special areas such as the Fine Arts center, the walls were filled with sand to further diminish the impact of sound from adjoining classrooms.

Making Sandra Day O'Connor High School a high performance building was accomplished while Marmon Mok worked to meet the district's requirements. The widespread use of an eight-foot (2.44-meter) awning, extending over the windows and entrance doors, worked with the concrete masonry to improve the energy efficiency of the building shell while providing daylight for each classroom in a manner that avoided excessive heat gain. The light limestone color of the masonry veneer units was a distinctive complement in this regard.





Another area in which Reeves and his colleagues take pride is in the environmentally sensitive site plan. Based upon discussions with community representatives, the design team gained a heightened concern for issues of stormwater runoff, traffic congestion and the spillover of light from this facility into the sparsely populated town of Helotes. By choosing to locate the building far back from the principal highway into town and on slightly higher ground, the impact of light and traffic problems were reduced and the stormwater runoff from the building and parking areas flowed directly towards and was absorbed by the athletic fields.

When you look over the design of Sandra Day O'Connor High School it is no wonder that the Panthers are committed to the sprit of success and the performance which contributes to those achievements. The school design reflected those principles and has created an environment where students and faculty alike can be motivated to reach for excellence. ■

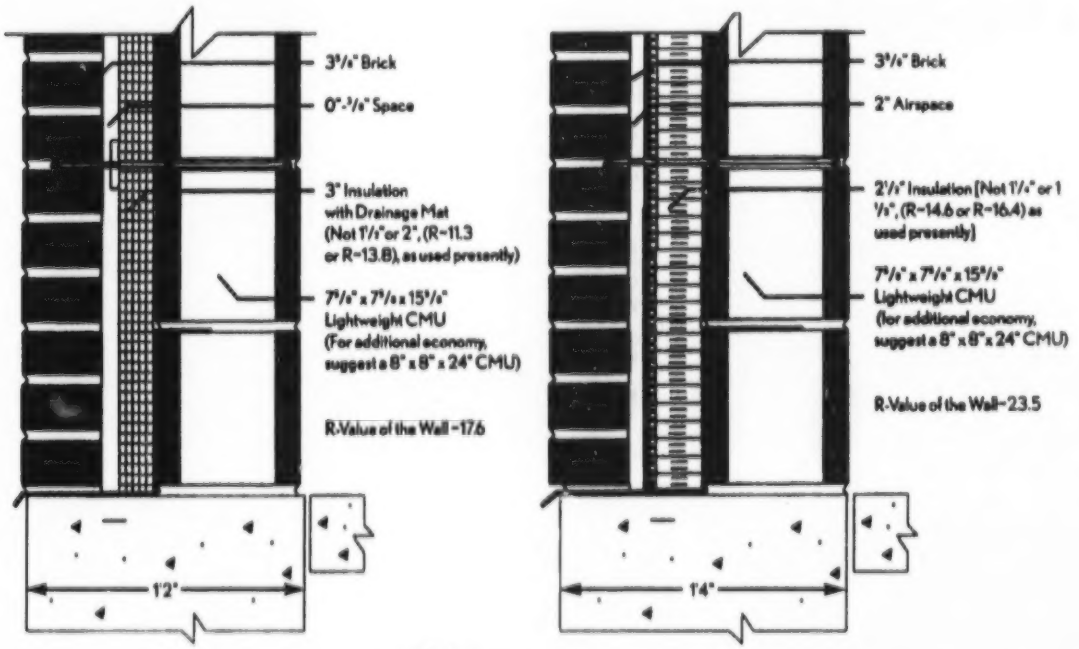
More Energy-Efficient School Designs for New Construction

Existing facilities, depending on when they were built, have somewhat limited and expensive solutions to upgrading the existing insulation barriers against severe weather conditions. On the other hand, new buildings and additions can be constructed with 21st century user and taxpayer friendly standards, which are dramatically more energy and cost efficient.

Maximizing energy efficiency reduces operating budgets, which is a primary concern of school administrators considering the escalating costs for energy. To combat inefficiency in design, there are several questions to be answered before jobs are bid and buildings built. Compounding this issue, in addition to the design of the structure, is the annual cost of the energy itself. Rates for electricity and natural gas have doubled and in some cases tripled over the past months. With little control over these economic forces, the investment now in constructing more energy-efficient school buildings pays substantial dividends long after the bonds are retired.

Under the "speed of construction" umbrella many projects have developed "scope"drawings for bidding purposes. If we continue to use vague, energy-inefficient scope drawings for the lowest price then we will continue to build energy inefficiency into our buildings. The following drawings for exterior wall sections are highly detailed with specific types and thicknesses of rigid insulation to be used to build more energy-efficient schools.

There would not normally be any extra labor charge to install one insulation over another. The only added cost would be for the "thicker" rigid insulation. At approximately $0.75 per square foot the masonry's exterior wall cost increases by 3.5%. This choice would yield reduced heating and cooling costs by as much as 53% through its walls for the life of the building. Consider also putting more and thicker insulation into the roof systems, energy-efficient windows, double-door entrances, setback thermostats, energy-efficient motors and more energy-efficient electrical and mechanical systems. Then, the long-term savings become even more impressive. ■


3⁵/₈" Brick
0"-³/₈" Space
3" Insulation with Drainage Mat (Not 1⁷/₈" or 2", (R-11.3 or R-13.8), as used presently)
7⁵/₈" x 7⁵/₈ x 15⁵/₈" Lightweight CMU (For additional economy, suggest a 8" x 8" x 24" CMU)
R-Value of the Wall -17.6
1'2"
3⁵/₈" Brick
2" Airspace
2⁷/₈" Insulation (Not 1⁷/₈" or 1 ⁷/₈", (R-14.6 or R-16.4) as used presently)
7⁵/₈" x 7⁵/₈" x 15⁵/₈" Lightweight CMU (for additional economy, suggest a 8" x 8" x 24" CMU)
R-Value of the Wall-23.5
1'4"

24

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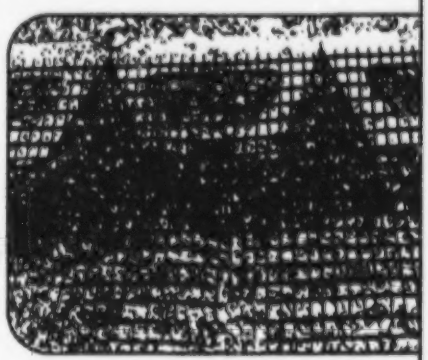

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